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(51) INT CL<sup>6</sup>

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(56) Documents cited

US 4792142 A

US 4786058 A

US 4695051 A

US 4422646 A

US 4346901 A

(58) Field of search

UK CL (Edition K) F3C CTL CTP

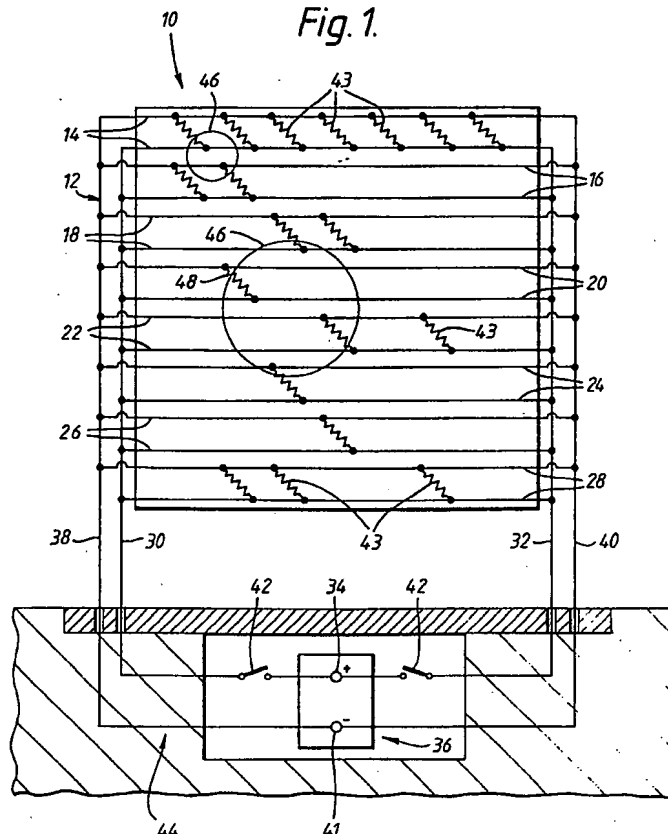
INT CL<sup>6</sup> F41J, H05B

Online databases: WPI, CLAIMS Inspec.

(54) Heat generating target

(57) A target 10 suitable for the use of practice missiles which are aimed and fired from a weapon fitted with thermal imaging night sights, is provided with an electrical ring main system in which the or each ring main is bridged by numbers of electrical resistive heaters 43. When a missile strikes the target, only those heaters 43 which have their electrical connections with the ring main broken are effectively removed from the target heating system. The heaters 43 which surround the resulting puncture remain effective, by virtue of use of the ring main system. The heaters may be embedded in tiles (50, Fig 2), each with a heater resistance chosen to provide a target of given overall characteristics (e.g. local hot spots).

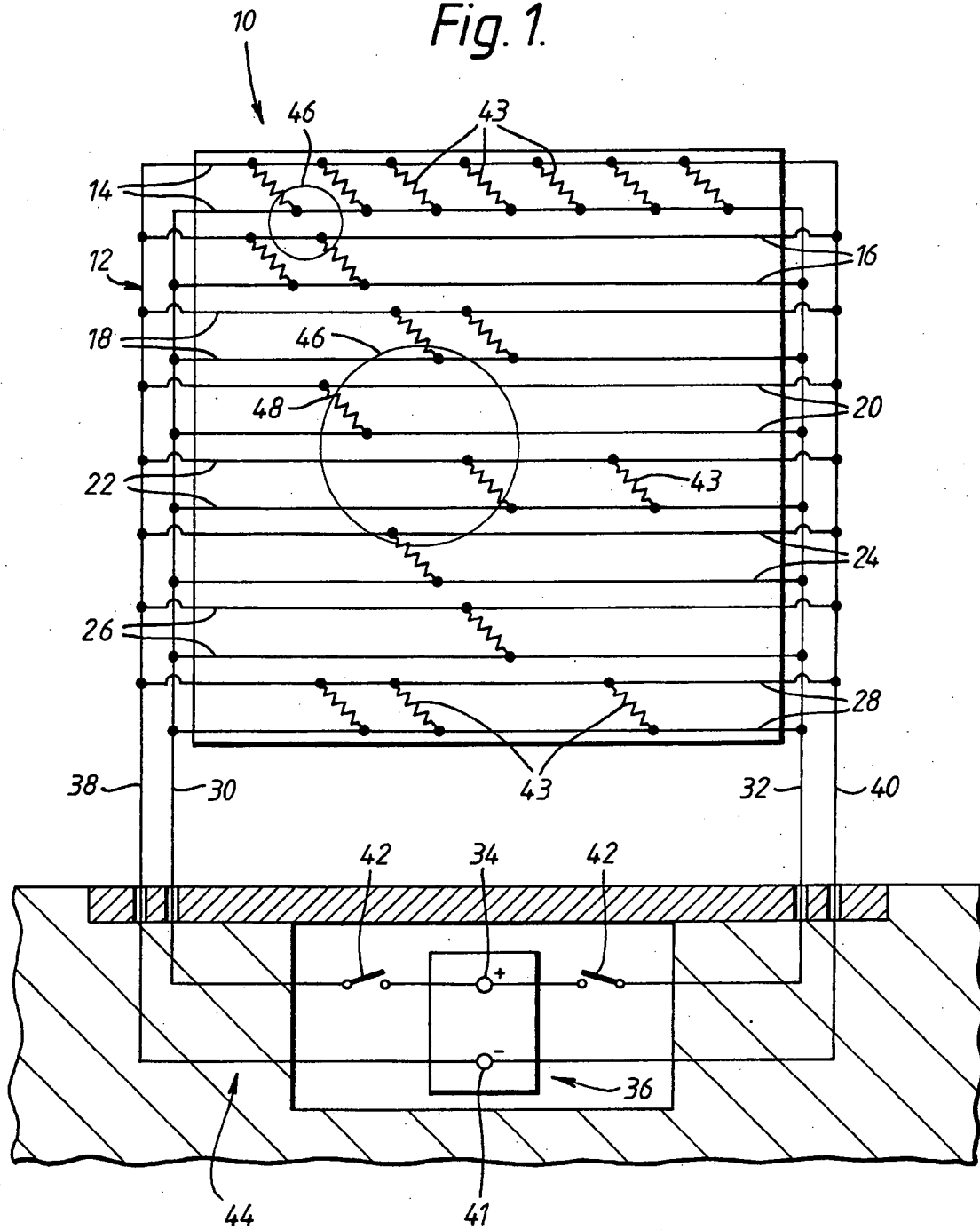
Fig. 1.



At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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Fig. 1.



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Fig. 3.

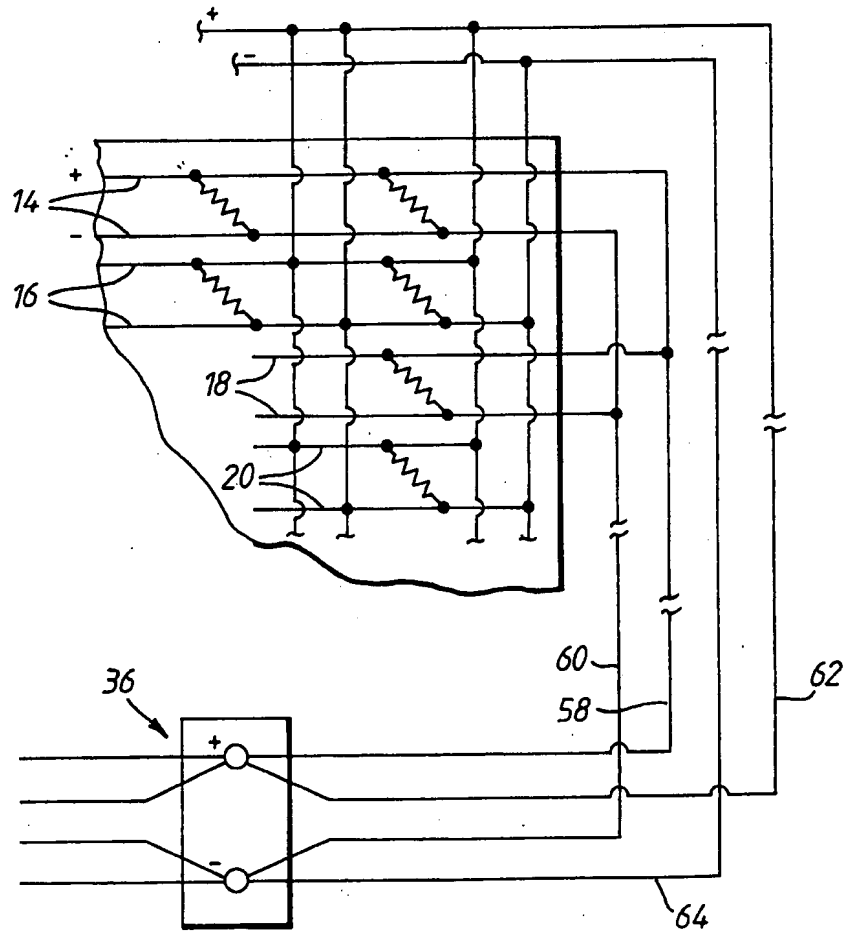
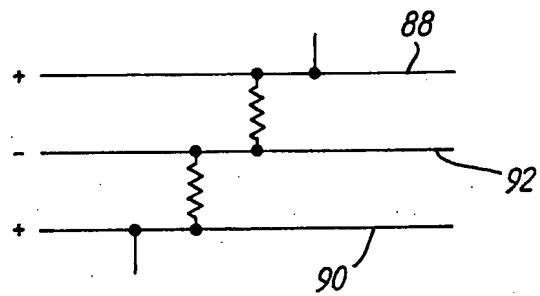


Fig. 4.



HEAT GENERATING TARGET

The present invention relates to a target of the kind which generates sufficient heat as to be detectable by known thermal imaging weapon night sights.

It is known to form a heat generating target from a sheet of non-electrically conductive material on which a desired outline is applied, using an electrically conductive paint.

On application of an electric current to the paint, the paint acts resistively and heat is thus generated.

Varying the thickness of the painted outline enables local hot spots to be created and, by this means, different images may be presented for detection by the night sight. Thus several forms may be devised e.g. human or mechanical.

A serious drawback exists in the known system, in that if a projectile which has been fired at the target and cuts or clips the painted line, then either the electrical power and therefor the means of producing the heat, is lost, or the new distribution of the current due to partial severance of the paint line, results in the surface temperature patterns in the sheet shifting from their original areas. In either instance the target may have to be discarded prematurely.

The present invention seeks to provide an improved heat generating target, suitable for use in weapon training at night, being detectable by thermal imaging night sights.

According to the present invention, a heat generating target, capable of being detected by a thermal imaging night sight comprises an electrically inert member having considerable side area relative to its thickness and is provided with at least one ring main circuit in the plane of one side or a plane parallel therewith, and a plurality of electrical resistive heating elements, each said element being connected across the or one of said ring mains in parallel with at least some of the other

elements, the at least one ring main being connectable to electrical power source means remote from the target.

The invention will now be described, by way of example and with reference to the accompanying drawings in which:

Figure 1 is a diagrammatic view of a target and its associated resistive heating electrical circuit according to an aspect of the present invention.

Figure 2 is a diagrammatic view of an alternative arrangement of a said target.

Figure 3 is a diagrammatic view of an alternative manner of wiring the example of Figure 2.

Figure 4 is an alternative form of wiring the target.

Referring to Figure 1. A rectangular target 10 is made from a material which is self supporting, but non electrically conducting. The target 10 may be made in the form of a single sheet, i.e. its major surfaces have considerable area relative to its thickness (not shown). Alternatively it may be of a laminated construction. The material is rupturable in the immediate locality which may receive a blow, as from a missile which is directed at it.

The target 10 may be supported for standing on one edge on the ground, or suspended from a frame (not shown) or in any manner which will ensure its appropriate presentation to the missile source.

A network of electrical circuits 12 is either embedded in the target should it be solid, or between layers, if the target is constructed from a number of laminates. The network 12 consists of a number of DC ring mains which, in the present example are made up from eight pairs of parallel wires each pair being respectively numbered 14,16,18,20,22,24,26 and 28.

One wire of each pair of wires 14 to 28 is connected by its opposing ends, to respective wires 30 and 32 which in turn are connected to a common positive terminal 34 of a DC power source 36.

The other wire of each pair of wires 14 to 28 is connected by its opposing ends, to respective wires 38 and 40 which in turn are connected to a common negative terminal 41 of the DC power source 36.

Each pair of wires 14 to 28 is bridged by a number of electrically resistive heaters 43. Not all of the heaters 43 are shown, but it may be assumed that by way of example, they are arranged in rows as depicted with respect to wires 14.

When switches 42 are closed, the circuit is operational and the heat generated by the resistance in the heaters 43 as a result, is sufficient to be viewed by the missile controller to such an extent that he may discriminate specific parts of the target and to guide the missile to the desired point of impact.

The DC power source 36 is stored in a missile proof bunker 44 at a place near to the target, so as to maintain the run of wiring to a minimum length, and the switches 42 may be operated by remote control (not shown).

Generally, the size of the target 10 will be dictated by the cross sectional area of the missiles which will be fired at it. Thus a missile which makes a puncture of the size, or less, depicted by the ring 46, will only destroy two heaters 43, and will not interrupt the power supply to the remaining heaters 43 anywhere on the target. Clearly, many missiles of a similar magnitude may be fired at the target before the target needs repair or replacement.

The use of overlarge missiles, having regard to the size of the target, so that punctures of a magnitude depicted by the circle 48 are created, will reduce the target availability much more quickly, but not nearly as quickly as prior art arrangements.

Referring now to Figure 2. In this example, the wiring circuitry 14,16,18,20,22,24,26 and 28 and power source 36 are identical with those described in connection with Figure 1. The sheet 10 however (not shown in Figure

2) has a number of tiles 50 covering that major surface which faces the target source. The tiles 50 are electrically insulated from each other by a grid of insulation 52.

Each tile has a resistive heater 43 embedded in it, and when the switches 42 are closed, each tile 50 is heated by its respective heater 40.

A missile which strikes the target and makes a puncture as indicated by the ring 54, will remove those tiles marked 'X' and consequently, the heat which had been provided thereby. A missile which produces a puncture as indicated at 56 will only remove those tiles marked 'Y'. In both cases, ample heat sources are left with which to determine other points of impact without a break in the test programme. By means of interchangeable heater tiles which may be of several different electrical ratings it is possible to construct a multiplicity of target images each having the thermal characteristics of a 'real' target which is to be attacked.

Figure 3 depicts an arrangement in which the pairs of wires 14,18,22 and 26 (the latter two pairs not being shown) are included in the circuit of output and input lines 58 and 60, and the pairs of wires 16,20,24 and 28 (the latter two pairs not being shown in Figure 3) are included in the circuit of output and return lines 62 and 64.

In Figure 4, two positive inputs 88 and 90 share a common return line 92.

Whilst in all examples, only one power source 36 has been shown for all ring mains, any number can be used, to the point where each ring main has at least one individual power source 36. Moreover, whilst d.c. power is described, clearly a.c. power can be used instead. Thus, if convenient and available, power from the national grid may be used, if suitably transformed down to an appropriate voltage.



If battery power is used as the power source, known charging means e.g. in the form of a diesel powered charger, may be used to keep the battery or batteries in good order.

An alternative arrangement utilises resistive heaters which vary in resistivity with respect to some or all of the remainder. By this means higher heat intensities can be achieved in selective areas, than in remaining areas and a target of specific shape may be defined thus.

## Claims:-

1. A heat generating target capable of being detected by a thermal imaging night sight and comprising an electrically inert member having considerable side area relative to its thickness and provided with at least one ring main circuit in the plane of said side or a plane parallel therewith, and a plurality of electrical resistive heating elements, each said element being connected across the or one of said ring mains in parallel with at least some of the other elements, the at least one ring main being connectable to electrical power source means remote from the target.
2. A target as claimed in claim 1 wherein said member comprises a backing sheet backing a number of electrically separated tiles, each of which has circuitry which when the tiles are in situ is electrically connected to form the at least one ring main.
3. A target as claimed in claim 1 or claim 2 including a plurality of said ring mains.
4. A target as claimed in claim 3 wherein said plurality of ring mains are arranged in a regular manner.
5. A target as claimed in claim 3 or claim 4 wherein the ring mains are arranged in parallel rows.
6. A target as claimed in claim 3 or claim 4 wherein the ring mains are arranged in overlapping rows.
7. A target as claimed in any previous claim wherein the electrical power source means provides a direct current.
8. A target as claimed in any of claims 1 to 5 wherein the electrical power source means provides an alternating current.
9. A target as claimed in any previous claim wherein the or each ring main receives power from a common, single electrical power source.
10. A target substantially as described in this specification and with reference to the respective Figures 1 to 4 of the drawings.

Amendments to the claims have been filed as follows

1. A heat generating target capable of being detected by a thermal imaging night sight and comprising an electrically inert backing sheet having considerable side area relative to its thickness and supporting a number of electrically separated tiles on one side, each tile including circuitry which when said tiles are in situ, electrically connect to form at least one ring main circuit in a common plane, and a plurality of electrical resistive heating elements, each said element being connected across the or a respective one of said ring mains in parallel with at least some of the other elements, the at least one ring main being connectable to electrical power source means remote from the target.
2. A target as claimed in claim 1 including a plurality of said ring mains.
3. A target as claimed in claim 2 wherein said plurality of ring mains are arranged in a regular manner.
4. A target as claimed in claim 2 or claim 3 wherein the ring mains are arranged in parallel rows.
5. A target as claimed in claim 2 or claim 3 wherein the ring mains are arranged in overlapping rows.
6. A target as claimed in any previous claim wherein the electrical power source means provides a direct current.
7. A target as claimed in any of claims 1 to 5 wherein the electrical power source means provides an alternating current.
8. A target as claimed in any previous claim wherein the or each ring main receives power from a common, single electrical power source.
9. A target substantially as described in this specification and with reference to the respective Figures 1 to 4 of the drawings.

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**Patents Act 1977**  
**Examiner's report to the Comptroller under**  
**Section 17 (The Search Report)**

Application number

9114843.7

**Relevant Technical fields**

(i) UK CI (Edition <sup>K</sup> ) F3C: CTP, CTL

(ii) Int CI (Edition <sup>5</sup> ) F41J H05B

**Search Examiner**

G A McLEAN

**Databases (see over)**

(i) UK Patent Office

(ii) ONLINE DATABASES: WPI, CLAIMS, INSPEC

**Date of Search**

24 SEPTEMBER 1991

Documents considered relevant following a search in respect of claims 1-10

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X,Y	US 4792142 (DAVIES) - whole document especially lines 32-40 column 5	1-5, 7-9
Y	US 4786058 (BAUGHMANN) - whole document	1-5, 7-9
Y	US 4695059 (FUJI) - especially lines 47-57 column 6; figures 7 & 8	1-5, 7-9
X,Y	US 4422646 (TVI) - especially lines 36-48 column 1; lines 16-41 column 2; line 67 column 2 - line 3 column 3 lines 58-68 column 3	1-5, 7-9
X,Y	US 4346901 (SPERRY) - whole document	1-5, 7-9

SF2(p)

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Category	Identity of document and relevant passages	Relevance to claim(s)

#### Categories of documents

**X:** Document indicating lack of novelty or of inventive step.

**Y:** Document indicating lack of inventive step if combined with one or more other documents of the same category.

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**P:** Document published on or after the declared priority date but before the filing date of the present application.

**E:** Patent document published on or after, but with priority date earlier than, the filing date of the present application.

**&:** Member of the same patent family, corresponding document.

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